

FARM BUSINESS MANAGEMENT



ECONOMICS OF ON-FARM FEED PROCESSING

ATLANTIC COMMITTEE ON SOCIO-ECONOMIC SERVICES

FOREWORD

This publication is one of a series on Farm Business Management prepared by a Sub-Committee of the Atlantic Committee on Socio-Economic Services and published by authority of the Ministers of Agriculture of Nova Scotia, New Brunswick and Prince Edward Island.

Material for this publication was prepared by Jim Houghton, Farm Management Specialist, Nova Scotia Department of Agriculture and Marketing. The author drew some material from a 1979 publication prepared by Rollie Hayman and David Clark of the Nova Scotia Department of Agriculture and Marketing, and wishes to acknowledge this fact. We further acknowledge the efforts of Tracey Mitchell for the secretarial work.

JANUARY 1985

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INTRODUCTION

OBJECTIVES

In general terms, the objective of this publication is to provide information about on-farm feed processing as an alternative method of providing feed for livestock. Technical and cost data was collected for three (3) types of feed processing systems, unit output costs for these three (3) types of systems were calculated according to the volume of feed used.

This publication attempts to make provisions for all costs involved in owning and operating a feed mill, except management. The ownership costs include depreciation, interest on capital tied up in facilities, insurance, taxes, housing and maintenance. Operating costs include labor, whether hired or provided by the farmer and/or his family, interest on operating capital, repairs and electricity to run the mill (or tractor costs for a portable mill).

The budgets are based on a set of costs and assumptions as of July, 1984. A number of the costs will change from time to time (i.e. interest rates) and place to place (i.e. hydro costs). Individual farmers considering the purchase of on-farm feed processing facilities should substitute their own costs where applicable. Hopefully, this publication will provide farmers with a framework for analyzing the investment.

METHODOLOGY

A wide variety of information sources were used in researching basic data for this publication. Extension Agricultural Engineers provided technical data and cost estimates. Livestock nutritionists provided information on livestock feed requirements. Feed companies provided information on complete rations and ingredient costs. Machinery dealers provided estimates on machinery and equipment costs.

Detailed input-output information was still difficult to obtain, even with many sources of information. Recourse was made to estimate from outside sources where data proved inadequate or inconsistent. Partial budget analysis was prepared for three (3) commonly used on-farm feed processing systems. These include, (1) electric mix mill with enough storage to buy grain in rail-car lots (60-80 T), (2) electric mix mill with enough storage to buy grain in truckload lots (10T), and (3) portable mix mill.

ALTERNATIVES IN ACQUIRING FEED

The feed expense is the largest item of expense found on most farm businesses. For example, feed represents 45-60 percent of the cost of producing milk, 70-75 percent of the cost of raising a market hog and 75-80 percent of the cost of producing a dozen eggs. With the steady rise of all costs over the past number of years, improving the cost-price relationship in livestock production increasingly becomes a matter of reducing feed costs. This may be accomplished by increasing feed efficiency and/or reducing the cost per unit of feed.

This publication concentrates on the latter - reducing per unit feed costs. More specifically, reducing per unit feed costs by on-farm feed processing.

The farm operator has a number of ways at his disposal for acquiring his livestock feed. These include:

- (1) Purchasing a complete prepared ration from a dealer.
- (2) Move home grown grain to a commercial mill for milling and mixing with purchased pre-mixes and concentrates.
- (3) Have home grown grain milled with concentrate and pre-mixes by a custom mobile feed milling service (available to some parts of Atlantic Canada only).
- (4) Purchase feed processing equipment and mill feed on the farm. Ingredients may be purchased and/or home grown.

We consider alternative four (4) in this publication. That is, the purchase of feed processing equipment and milling on the farm. More specifically, we consider purchasing the ingredients as opposed to utilizing home grown ingredients. This is done to separate the grain growing function from that of feed processing so that the economics of each can be shown.

There are a number of comments that should be made at this point concerning the purchase of a commercial ration versus a home mixed ration. Each alternative has a number of advantages and disadvantages.

Commercial feed dealers have always provided farmers with a wide range of services in addition to the feed that has been purchased. Services such as handling and purchasing of feed ingredients, formulation and mixing of rations, financial services, along with feeding and production advice usually come along with the feed. These services, of course, have not come without cost - the charge is included in the selling price of the feed.

Commercial mills produce a wide variety of livestock rations that are available in many different sizes and forms. Each time a feed changes form or is moved, the per unit cost increases. The commercial dealer, to stay in business, must recover a sufficient margin above costs to provide for these services and administrative costs. The dealer, in turn, provides a quality product that meets minimum specified standards. The farm operator is assured of this when he purchases a commercial ration.

The farm operator who owns his own mill may be able to reduce handling, administration and diversification costs. In all probability, the producer mixes only one or two different rations. All feed is handled in bulk and in mash form. Therefore, an operator specializing in a single bulk mash feed has no inherent diversification charge. This may provide a cost advantage over a commercial mill.

Today, more individual feed services are available to producers from government and private sources. The services include advisory services for livestock nutrition and feed formulation as well as feed analysis. It would seem

reasonable that a farm operator hire only those services that cannot be obtained from the sources listed above or which he cannot provide economically himself.

If the farm business is large enough, bulk buying of feed ingredients has some cost advantages. Bulk buying can result in lower average prices and reduced handling.

On-farm feed processing can more fully utilize excess labor, building space and tractor capacity^{1/}. If these are available, further cost advantages are available to the farm operator.

In addition to the advantages, there are a number of disadvantages that must be recognized. On-farm feed processing requires a careful analysis of the management and labor resources. It is often a common fallacy to underestimate the labor and management involved in running a feed mill. It is often assumed that additional labor requirements will be provided by the present labor resource, without resort to additional hired labor. If a busy operator spends less time managing the livestock enterprise(s), then he may experience a drop in production. Any drop in production will have a negative impact on potential savings in feed costs. As a general rule of thumb, it is recommended that a farm operator consider a feed mill only if, (1) he is satisfied that all other aspects of his operation are being managed efficiently, and (2) management and labor resources are available to run the mill.

Mixing and grinding a ration on the farm requires careful attention to detail. The rations must be well mixed - otherwise, separation of the various ingredients can become a serious problem. Feed quality must be consistent if livestock are to remain "on feed" and maintain high levels of production.

^{1/} A portable mixer will require the use of a tractor on a year-round basis, permitting a higher utilization rate and therefore spreading the fixed costs of the tractor.

On-farm feed processing implies that the operator have a working knowledge of the nutrient content of various feed ingredients and also, have some knowledge of the feed grain market if cost savings are to be achieved by bulk buying.

An operator who installs a feed mill will likely experience an increase in operating capital requirements, particularly if grain is being purchased in large quantities (i.e. railcar lots). Many operators carry a revolving account payable with their feed dealer where payment is not due until a few days after delivery (i.e. ten days). A farmer who switches to a home mixed ration will have to, (1) pay for the feed that has been delivered and fed, and (2) pay for grain on delivery. He must therefore have enough financial flexibility to borrow additional short term capital.

ECONOMIC ANALYSIS

A number of assumptions were made regarding feed requirements, the composition of livestock rations, costs and volumes. These assumptions are outlined in the next five (5) sub-sections. This is followed by a series of budgets based on these assumptions.

The figures presented are meant to provide rule-of-thumb guidelines only. Estimates of potential savings from on-farm feed processing can vary from farm to farm. The final Appendix to this report is a worksheet which can be used by individual farmers in assessing the potential savings from installation of an on-farm feed processing system.

FIXED COSTS

Fixed costs are the "ownership" or overhead costs of feed processing equipment. Fixed costs include, depreciation, interest, maintenance, taxes and insurance. Total fixed costs per year are the same regardless of the quality of feed milled. However, fixed costs per tonne varies greatly

with the volume of feed milled. For example, fixed costs per tonne will be halved for an operation that puts through four hundred (400) tonnes per year versus two hundred (200).

The following formulas and rates were used to determine annual fixed costs.

- (i) Depreciation - An annual charge to cover the "using up" of a capital asset over a period of years.

$$\text{Depreciation} = \frac{\text{Cost} - \text{Salvage}}{\text{Years Useful Life}}$$

- Salvage value assumed to be ten (10) percent of cost.
- Buildings and storage facilities assumed to have a useful life of twenty (20) years; electric mix mills and augers seven (7) years; and portable mix mills ten (10) years.

- (ii) Interest - An annual charge to cover the amount of capital that is tied up in an asset. An operator will pay interest on a loan used to install a feed milling system. Alternatively, if an operator uses his own capital, he will forego interest that could be earned by placing the money in an interest bearing account. This is known as an "opportunity cost". The interest rate used in this publication is fourteen (14) percent. A word of caution here. Individual operators should base their calculations on the interest rate that is applicable to them. A substantial increase in interest rates will obviously increase ownership costs. If borrowed funds are used to construct a mill at floating interest rates, the operator should take into consideration the possibility of increased loan repayment requirements.

$$\text{Interest} = \text{Average Cost} \times 14\% - \text{Average Cost}$$

$$= \frac{\text{Initial Cost} + \text{Salvage}}{2}$$

- (iii) Insurance - The rate is six dollars (\$6.00) per thousand dollars (\$1,000.) of coverage.

- (iv) Taxes - Estimated at one (1) percent of initial cost of buildings and storage. This cost does not apply to portable mix mills.
- (v) Maintenance and Repairs - This has been estimated at three and a half ($3\frac{1}{2}$) percent of original cost for the portable mix mill. This cost has been split into two components for the electric mills and corresponding grain storage systems. The fixed portion is estimated to be one and a half ($1\frac{1}{2}$) percent of initial cost and represents maintenance. This includes an annual cleaning and disinfection of the system. The variable portion is referred to as repairs and is estimated at \$1.00 per tonne. This will be included as an operating cost.
- (vi) Housing - This cost is used in the portable mix mill calculations only, and is estimated as one and a half ($1\frac{1}{2}$) percent of the initial cost. Mill housing is provided for in the electric mix mill original cost estimates. It is therefore not necessary to provide a separate annual cost for housing.

The fixed costs discussed above are summarized in Table 1 for three (3) on-farm feed processing systems. System 1 consists of an electric grinder mixer with a grain centre and three hundred (300) tonnes of bulk storage. The estimated capital cost is \$50,000.00. The storage capacity permits the operator to purchase grain and soybean meal in railcar lots of seventy-five (75) tonnes, thereby acquiring it at its least cost on a per tonne basis. System 2 has the same mill, but has less storage capacity. The capital cost of this system is \$30,000.00. Grain and soybean meal are purchased in truckload lots of ten (10) tonnes. System 3 is a portable mix mill with an estimated cost of \$11,000.00. It is assumed that there is sufficient on-farm storage available to store grain in truckload lots of ten (10) tonnes. However, the storage is limited, necessitating the mixing of a simplified ration consisting of grain and supplement which is purchased in forty (40) kilogram bags.

TABLE 1: ANNUAL FIXED COSTS FOR FEED MILLING AND STORAGE SYSTEMS

ITEM	SYSTEM 1	SYSTEM 2	SYSTEM 3
Mill, Augers, Motors	\$16,500. ^{1/}	\$15,000. ^{2/}	\$11,000. ^{3/}
Buildings, Storage, etc.	<u>33,500.</u>	<u>15,000.</u>	<u>-0-</u>
TOTAL COST	<u>\$50,000.</u>	<u>\$30,000.</u>	<u>\$11,000.</u>
<u>ANNUAL FIXED COSTS:</u>			
Depreciation	\$ 3,629.	\$ 2,604.	\$ 990.
Interest	3,850.	2,492.	847.
Insurance	300.	180.	66.
Taxes	335.	150.	-0-
Maintenance (and repairs ^{4/})	750.	450.	385.
Housing	<u>-0-</u>	<u>-0-</u>	<u>165.</u>
TOTAL ANNUAL FIXED COSTS	<u>\$ 8,864.</u>	<u>\$ 5,876.</u>	<u>\$ 2,453.</u>

Notes:

- 1/ System 1 is a 5-7½ H.P. electric grinder mixer with grain center and 300 tonne of storage. Storage is sufficient to purchase grain and soybean meal in railcar lots of 75 tonnes.
- 2/ System 2 is a 5-7½ H.P. electric grinder mixer housed in a steel grain tank. There is sufficient storage to purchase grain and soybean meal by the tonne in truckload lots.
- 3/ System 3 is a two tonne portable mix mill. Grain is purchased in bulk in truckload lots. Supplement is purchased in forty (40) kg. bags.
- 4/ Maintenance only for systems one (1) and two (2). Repairs and maintenance for system three (3). See preceeding discussion in the text.

OPERATING COSTS

Operating costs will cover all those charges that vary directly with the quantity of feed that is milled. They include labor, whether hired or supplied by the operator and his family. Electricity to run the grinder mixer is also an operating cost for systems one and two. The corresponding cost for the portable grinder mixer is the cost of running the tractor. This includes gas and oil, repairs and additional wear and tear (depreciation). The operating costs for the three feed milling systems are summarized in Table 2.

TABLE 2: PER TONNE OPERATING COSTS

ITEM	ELECTRIC MILL	PORTABLE MILL
Labor - \$5.50/Hour	\$ 0.92 ^{1/}	\$ 1.83 ^{2/}
Electricity	0.23 ^{3/}	-0-
Repairs	1.00	-0-
Tractor - Gas, Oil	-0-	1.23 ^{4/}
- Repairs	-0-	0.64 ^{5/}
- Depreciation	-0-	2.96 ^{6/}
TOTAL OPERATING COSTS PER TONNE	\$ 2.15	\$ 4.66

Notes:

- 1/ Milling capacity of 1.0 tonnes per hour requiring 10 minutes per hour.
- 2/ 100 bushel tank will process 3.0 tonnes of feed per hour, including loading and unloading. Forty (40) minutes of labor required per batch of feed.
- 3/ 3.75 kwh of electricity @ \$.06 per kwh.
- 4/ 1.2 gallons of gasoline per batch (2 tonnes) @ \$1.78 per gallon plus 15% for lubrication.
- 5/ Repair rate of \$1.92 per hour. Based on a repair rate of \$.08 per \$1,000. of replacement cost.

6/ Depreciation to cover added wear and tear to tractor.

$$\begin{aligned}\text{Depreciation} &= \frac{\$24,000. - \$2,400.}{15 \text{ Years}} + 500 \text{ Hrs.} \\ &= \$2.88 \text{ per Hour or } \$0.96 \text{ per Tonne}\end{aligned}$$

The interest cost of inventory covers the carrying cost of storing grain and soybean meal on the farm. The interest cost of inventory is assumed to be fourteen and a half (14.5) percent in this publication. The cost per tonne depends upon how long the grain is stored on the farm, which in turn will depend upon the annual volume of feed useage. System 1 has total storage capacity of three hundred (300) tonnes, with grain and soybean meal being purchased in seventy-five (75) tonne railcar lots. If, for example, annual feed volume is three hundred (300) tonnes, then grain and soybean meal will be purchased for one year. The interest cost of inventory is \$14.16, which is calculated by multiplying the per tonne mixed feed cost of grain and soybean meal (\$195.36) by the annual interest rate (14.5%) and then dividing by the number of turns per year (1) and finally dividing by two (2). We must divide by two, because on average, the grain storage is only half full.

Table 3 summarizes the interest cost of inventory for System 1 at various levels of feed useage. No provision has been made to include the interest cost of inventory for Systems 2 and 3. Grain is purchased in truckload lots of ten (10) tonnes and therefore has a fairly rapid turnover. The interest cost of inventory in these instances is less than \$1.00 per tonne, and at large volumes is not more than a few cents.

TABLE 3: INTEREST COST OF INVENTORY FOR SYSTEM 1

VOLUME OF FEED PER YEAR (TONNES)	INTEREST COST OF INVENTORY PER TONNE
200	\$ 21.24
300	14.16
400	10.63
500	8.50
600	7.08
800	5.31
1,000	4.25

Notes:

- (1) Interest rate of 14.5% on cost of \$195.36 for barley and soybean meal contained in one (1) tonne of hog grower. Description of ration contents and ingredient costs are contained in Appendix I.
- (2) Total storage capacity of 300 tonnes of grain and soybean meal.

HOME MIXED RATIONS

The formulation of commercial feeds may change frequently. It is therefore difficult to establish the cost of an exactly comparable tonne of feed processed on the farm. A set of home mixed rations were drawn up by specialists in the Nova Scotia Department of Agriculture and Marketing to assist in the analysis. Commercial rations usually contain more ingredients than the home mixed rations contained in Table 4. This provides a broader base for ingredient substitution by the feed companies, allowing them to take maximum advantage of grain and concentrate price changes. The home mixed rations are simple, yet entirely satisfactory in terms of nutrition.

It should be noted that there are basically three (3) types of home mixed rations. They are (1) grain-supplement as in ration #3 in Table 4, (2) grain-macro mix of minerals and vitamins, and (3) grain-micro mix of minerals and vitamins. Rations 1 and 2 in Table 4 are the third type. Some operators avoid this type of a mix as it is more difficult to obtain a uniform mixing of ingredients. The grain-supplement type of ration is probably the easiest to mix uniformly. In terms of economy, there appears to be little difference between the three types of rations.

TABLE 4: HOME MIXED RATION INGREDIENTS

INGREDIENTS	(1) 16% DAIRY RATION KGS/T OF RATION	(2) 16% HOG GROWER KGS/T OF RATION	(3) 16% HOG GROWER KGS/T OF RATION
Barley	600	810	815
Corn	280	-	-
48% Soybean Meal	90	160	-
Dicalcium Phosphorus	20	10	-
Trace Mineralized Salt	10	-	-
Limestone	-	10	-
Salt	-	5	-
Vitamin Trace Mineral Pre-Mix	-	5	-
40% Hog Supplement	-	-	185
	1,000	1,000	1,000

COST OF RATION INGREDIENTS

Table 5 provides a summary of the ingredient costs for each of the home mixed rations, along with the price of similar commercial rations. Further details on the cost of individual feed ingredients can be found in Appendix I.

The prices used for the home mixed and commercial rations are based on FOB plant in Truro. No charge has been made for transportation to the farm. These charges will vary considerably depending on farm location in relation to the plant. However, the actual difference between the cost of a commercial and home mixed ration at the farm gate should remain the same as transportation charges for both should be equal.

The prices of home mixed and commercial rations are based on quotes in July, 1984. Past observation has shown that although prices change frequently, the difference between the two does not vary a great deal. It is the dollar amount of this "differential" that is important in comparing the total cost of a home mixed ration with a commercial ration.

The difference between commercial rations and home mixed rations is approximately \$48.-\$50. if grain and soybean meal are purchased in railcar lots. However, the operator will have to bear the interest cost of storing the grain on the farm. This differential shrinks to \$25.-\$30. if grain is purchased in truckload lots. The differential with the portable mix mill is approximately \$20. per tonne. We have assumed a simplified system where present on-farm storage facilities are available but are limited. Therefore, grain is purchased in truckload lots and supplement is purchased in 40 Kg. bags. Ingredient costs are calculated for the hog ration only.

The differential between commercial rations and home mixed ration ingredients is similar for both sixteen percent protein hog and dairy rations. Calculation of total costs of home mixed rations are based on the hog ration only in later sections of this publication to simplify the analysis. Costs and

savings for home mixed dairy rations (or other types of livestock rations) should be approximately the same as for the hog rations.

TABLE 5: COST OF HOME MIXED RATION INGREDIENTS
AND COMMERCIAL RATIONS: FOB TRURO, JULY, 1984

	16% HOG GROWER	16% DAIRY RATION
Commercial Rations	\$257.50	\$ 263.00
System 1 - Grain and Soybean Meal Purchased in Truckload Lots	\$208.99	\$ 212.30
System 2 - Grain and Soybean Meal Purchased in Truckload Lots	\$232.26	\$ 236.90
System 3 - Grain Purchased in Truckload Lots. Supplement in 40 Kg. Bags.	\$237.06	N/A

TOTAL COST OF HOME MIXED RATION

The total cost of a home mixed ration is the sum of the ingredient costs, operating costs of the mill, overhead costs and interest cost of inventory.

Tables 6-8 provide summaries of total costs for the three systems at various feed volumes. It can be clearly seen that annual feed volume plays a very important role in the total cost per tonne. This is because total annual overhead costs remain the same regardless of volume, but per tonne overhead costs decrease as volume increases.

The portable mix mill generates savings in feed costs at volumes in excess of two hundred (200) tonnes per year. The breakeven point is somewhere

around one hundred and seventy-five (175) tonnes. Savings per tonne declines fairly rapidly until about the four hundred (400) tonne level.

The breakeven point for the electric mix mill with grain being purchased in truckload lots is somewhere around two hundred and seventy-five (275) tonnes per year. Savings in feed costs on a per tonne basis continues to decline as feed volume increases, although there is some levelling off above six hundred (600) tonnes per year.

Installation of sufficient storage to buy grain in railcar lots will yield a breakeven at approximately three hundred (300) tonnes. This system offers the most economy in terms of net savings above the four hundred (400) tonne level.

TABLE 6: TOTAL COSTS OF HOME MIXED 16% HOG RATION FOR SYSTEM 1
(GRAIN AND SOYBEAN MEAL PURCHASED IN RAILCAR LOTS)

COSTS	ANNUAL VOLUME OF FEED USE - TONNES					
	200	300	400	500	600	800 1,000
Ingredients - 16% Hog Grower	\$208.99	\$208.99	\$209.99	\$208.99	\$208.99	\$208.99
Interest Cost of Inventory	21.24	14.16	10.63	8.50	7.08	5.31 4.25
Operating Costs	2.15	2.15	2.15	2.15	2.15	2.15
Fixed Costs	44.32	29.55	22.16	17.73	14.77	11.08 8.86
TOTAL COST PER TONNE	\$276.70	\$254.85	\$243.93	\$237.37	\$232.99	\$227.53 \$224.25
Net Savings (Cost) Per Tonne Over Commercial Hog Grower @ \$257.50	\$-(19.20)	\$ 2.65	\$ 13.57	\$ 20.13	\$ 24.51	\$ 29.97 \$ 33.25
Total Annual Savings (Cost)	\$-(38.40)	\$ 795.	\$ 5428.	\$10065.	\$14706.	\$23976. \$33250.
% Savings of Total Feed Costs	-0-	1.0%	5.3%	7.8%	9.5%	11.6% 12.9%

TABLE 7: TOTAL COSTS OF HOME MIXED 16% HOG RATION FOR SYSTEM 2
(GRAIN AND SOYBEAN MEAL PURCHASED IN TRUCKLOAD LOTS)

COSTS	ANNUAL VOLUME OF FEED USE - TONNES					
	200	300	400	500	600	1,000
Ingredients - 16% Hog Grower	\$232.26	\$232.26	\$232.26	\$232.26	\$232.26	\$232.26
Operating Costs	2.15	2.15	2.15	2.15	2.15	2.15
Fixed Costs	29.38	19.56	14.69	11.75	9.79	5.88
TOTAL COST PER TONNE	\$263.79	\$253.97	\$249.10	\$246.16	\$244.20	\$240.29
Net Savings (Cost) Per Tonne Over Commercial Hog Grower @ \$257.50	\$-(6.29)	\$ 3.53	\$ 8.40	\$ 11.34	\$ 13.30	\$ 15.74
Total Annual Savings (Cost)	\$-(1258.)	\$ 1059.	\$ 3360.	\$ 5670.	\$ 7980.	\$ 12592.
% Saving of Total Feed Costs	-0-	1.4%	3.3%	4.4%	5.2%	6.1%

6.7%

TABLE 8: TOTAL COSTS OF HOME MIXED 16% HOG RATION FOR SYSTEM 3
(PORTABLE MIX MILL)

COSTS	ANNUAL VOLUME OF FEED USE - TONNES				
	100	200	300	400	500
Ingredients	\$237.06	\$237.06	\$237.06	\$237.06	\$237.06
Operating Costs	4.66	4.66	4.66	4.66	4.66
Fixed Costs	24.53	12.27	8.18	6.13	4.91
TOTAL COST PER TONNE	\$266.25	\$253.99	\$249.90	\$247.85	\$246.63
Net Savings (Cost) Per Tonne Over Commercial Hog Grower @ \$257.50	\$-(8.75)	\$ 3.51	\$ 7.60	\$ 9.65	\$ 10.87
Total Annual Savings (Cost)	\$-(875.)	\$ 702.	\$ 2280.	\$ 3860.	\$ 5435.
% Saving of Total Feed Costs	-0-	1.4%	3.0%	3.7%	4.2%

\$ 11.69

\$ 7014.

4.5%

CAPITAL GRANTS

Capital grants on feed milling and storage facilities are available to some farmers in Atlantic Canada. For example, farmers in Nova Scotia can currently obtain a capital grant of forty (40) percent on feed milling and grain storage facilities. A farmer with a capital outlay of \$30,000. is eligible for a rebate of \$12,000., resulting in a net cost of \$18,000.00. The capital grant therefore serves to decrease annual fixed costs by forty (40) percent. The breakeven point in terms of feed volume is lowered as per toone feed costs decrease.

Tables 9 and 10 provide a summary of total costs and savings per tonne for the three milling systems, given a forty (40) percent capital grant. The fixed costs per tonne are based on sixty (60) percent of the costs reported in Tables 6, 7, and 8. These costs are added to the other relevant costs as listed in these earlier tables to come up with new total feed costs on a per tonne basis.

The capital grant services to decrease the breakeven point for each of the three systems by approximately one hundred (100) tonnes per year - from three hundred (300) to two hundred (200) for System 1; from two hundred and seventy five (275) to one hundred and seventy-five (175) for System 2; and from two hundred (200) to one hundred (100) for System 3.

TABLE 9: SUMMARY OF HOME MIXED RATION COSTS FOR 16% HOG GROWER
GIVEN A 40% CAPITAL GRANT

VOLUME TONNES PER YEAR	ELECTRIC MIX MILL		(3) PORTABLE MIX MILL
	(1) RAILCAR LOTS OF GRAIN	(2) TRUCKLOAD LOTS OF GRAIN	
100	\$ N/A ^{1/}	\$ 269.67	\$256.44
200	258.97	252.04	249.08
300	243.03	246.15	246.63
400	235.07	243.22	245.40
500	230.28	241.46	244.67
600	227.08	240.28	244.17

TABLE 10: SUMMARY OF NET SAVINGS PER TONNE FOR 16% HOG GROWER
GIVEN A 40% CAPITAL GRANT

VOLUME TONNES PER YEAR	ELECTRIC MIX MILL		(3) PORTABLE MIX MILL
	(1) RAILCAR LOTS OF GRAIN	(2) TRUCKLOAD LOTS OF GRAN	
100	\$ N/A ^{1/}	\$ -(12.17)	\$ 1.06
200	-(1.47)	5.46	8.42
300	14.47	11.35	10.87
400	22.43	14.28	12.10
500	27.22	16.04	12.83
600	30.42	17.22	13.33

^{1/} It would not make sense for an operator using 100 tonnes of feed per year to have stoorage for 300 tonnes. Therefore, there is no calculation of costs and savings for System 1 at a volume of 100 tonnes.

ALLOWABLE INVESTMENT

To establish the maximum investment in feed processing and feed storage facilities that can be justified for any livestock operation, it is necessary to first establish an acceptable rate of return on investment for the producer. An assumed arbitrary dollar return per tonne of feed processed may not yield a favourable rate of return.^{1/}

Definitions and Assumptions

- (1) Desired rate of return on investment is 15%.
- (2) Annual fixed costs as a percentage of investment for System 2:

Depreciation	8.7
Maintenance	1.5
Insurance	0.6
Taxes	0.5
Total	<u>11.3</u>
- (3) Cost Margin - The difference between the cost of a commercial ration and the ingredient cost of a home mixed ration.
- (4) Allowable Charges - The margin that is established to cover fixed costs and the desired return on investment.
- (5) Interest Cost of Inventory - The costs associated with holding the ingredient inventory such as interest or financial charges.
- (6) Operating or Variable Costs - The estimated costs per tonne to operate the proposed equipment.

^{1/} Suppose an operator desired a \$5.00 per tonne return for his management and capital invested in equipment. If the required investment per tonne is \$15.00, his rate of return is $5/15 = 33\%$. If the required investment is \$100.00 per tonne, the rate of return is $5/100 = 5\%$.

Procedure

- (1) Determine the Cost Margin per Tonne

$$\text{Cost Margin} = \text{Cost of Commercial Ration} - \text{Ingredient Cost of Similar Home Mixed Ration}$$

- (2) Calculate Allowable Charges per Tonne

$$\text{Allowable Charges} = \text{Cost Margin} - \text{Operating Costs and Inventory Costs}$$

- (3) Compute Allowable Investment per Tonne

$$\text{Allowable Investment} = \frac{\text{Allowable Charges}}{\text{Return on Investment} + \text{Percentage Fixed Costs}}$$

- (4) Determine Total Maximum Investment

$$\text{Maximum Investment} = \text{Allowable Investment} \times \text{Annual Feed Volume}$$

Example

A dairy farmer using 200 tonnes of feed per year desires a 15% return on a feed milling and grain storage investment.

Cost of Commercial 16% Dairy Ration	\$ 263.00
Less: Ingredient Cost of Home Mixed Ration	235.90
Cost Margin	<u>\$ 26.10</u>
Less: Mill Operating Costs	\$ 2.15
Interest Cost of Inventory	0.79
	<u>\$ 2.94</u>
Allowable Charges per Tonne	<u>\$ 23.16</u>

Allowable Investment per Tonne:

$$\frac{\$23.16}{15\% + 11.3\%} = \frac{\$23.16}{.263} = \$88.06$$

Maximum Allowable Investment:

$$\$88.06 \times 200 \text{ Tonnes} = \$17,612.$$

-
- (1) Based on grain and soybean costs of $\$218.62 \times .145 \times 10/200 \times .5$
 (where interest rate is 14.5%, volume of grain purchased is 10 tonnes,
 annual usage is 200 tonnes, and average grain inventory is 5 tonnes).

At this level of investment, all fixed and operating costs would be covered and the farmer would still receive a return of fifteen (15) percent on a total investment of \$17,612.00.

FINANCING

Most farmers involved with the installation of a feed milling system use borrowed capital to finance the project. These farmers must concern themselves with net cash flow in addition to the consideration of whether the investment is profitable or not. To determine if investment in a feed mill will be profitable, we calculate an annual charge for depreciation. It is a non-cash expense that is intended to write-off the initial cost of the investment over a period of years. The electric mix mills and grain storage systems have a blended depreciation rate of approximately thirteen (13) to fifteen (15) years, while the portable mix mill is written-off over a ten (10) year period. Total feed costs per tonne are based on these rates.

If a farmer finances the project over a five (5) year period, the annual principal and interest payments will be substantially greater than the sum of depreciation and interest charges as calculated earlier in this publication. The net savings (or costs) will be substantially different in terms of net cash flow. A farmer may actually end up paying more for his feed on a net cash flow basis until the mill is paid for. He should be aware of this and must be able to handle the extra financial load if financing is done on a five (5) year basis. In general terms, a loan of thirteen (13) to fifteen (15) years in length would be required to equate principal and interest payments with annual depreciation and interest charges for a System 1 and 2 type of investment.

In provinces where capital grants are available, as in Nova Scotia, a feed milling system can be financed over a shorter period of time to equate annual principal payments with annual depreciation charges. The term of loan could be shortened from thirteen (13) to seven (7) years for a type 2 system, given a capital grant of forty (40) percent.

INVESTMENT TAX CREDIT

The income tax system inevitably has an influence on capital investment decisions. The investment tax credit on new feed milling and storage equipment is twenty (20) percent of the initial cost. The tax credit is used to offset federal income tax payable. This results in a net saving in cash outlay at tax filing time for the farmer who is in a taxable position. An additional feature was added in the April 19, 1983 federal budget. Farmers are eligible to receive a forty (40) percent cash refund of unused investment tax credit on eligible expenditures made between April 19, 1983 and May 1, 1986.

CONCLUSIONS

A farmer considering the installation of on-farm feed processing facilities should include a number of cost factors in order to evaluate the investment.

Overhead costs include depreciation, interest, maintenance, taxes and insurance. The total annual overhead costs remain the same, regardless of volume of production. However, overhead costs on a per tonne basis are very dependent on the volume of production. Cost per tonne decreases as volume increases.

Operating costs include labor, whether hired or provided by the farmer, and hydro in the case of a electric mill, or tractor costs for portable mix mills. A repair cost of \$1.00 per tonne was included as an operating cost for electric mix mills.

The interest cost of inventory covers the financial charges for storing grain on the farm. This cost can be fairly substantial if the grain is stored for long periods of time (i.e. one year), conversely it can be negligible for short storage period.

Budgets of feed costs per tonne at various annual feed volumes were prepared for three (3) types of on-farm feed processing systems. System 1 consisted

of an electric mix mill with grain center and storage capacity for three hundred (300) tonnes of grain. Grain and soybean meal were purchased in railcar lots. The difference between a commercial ration and ingredient costs of a comparable home mixed ration was estimated to be \$48.-\$50.00. System 2 consisted of the same mill, but much less storage capacity. Grain was purchased in truckload lots. The ingredient cost was approximately \$25.-\$30. less than the cost of a comparable commercial ration. System 3 consisted of a portable mix mill with grain being purchased in truckload lots. The differential between a commercial and home mixed ration was estimated to be approximately \$20. per tonne. It was assumed that this system had the least amount of storage capacity. The budgets were based on a capital cost of \$50,000. for System 1, \$30,000. for System 2 and \$11,000. for System 3.

The net savings (or costs) per tonne of feed milled depended on the annual throughput for all three systems. The portable mix mill (System 3) offered savings at volumes in excess of two hundred (200) tonnes per year. System 2 (electric mix mill) broke even at an approximate annual tonnage of two hundred and seventy-five (275). The breakeven point for System 3 was estimated to be approximately three hundred (300) tonnes. This system was the most economical in terms of the greatest savings on a per tonne basis at volumes in excess of four hundred (400) tonnes per year.

Capital grants on on-farm feed milling and storage facilities serve to decrease annual overhead costs and therefore total per tonne costs of home mixed rations. A series of budgets were presented for the three milling systems based on a forty (40) percent capital grant. The grant served to decrease the breakeven point for all three systems by approximately one hundred (100) tonnes.

Farmers installing feed mills with the use of borrowed funds should take care in setting up the repayment terms of the loan. In most cases, a loan of at least ten (10) years in length is required for a farmer to achieve savings in feed costs on a cash flow (actual out of pocket expenditures) basis. The term may decrease where capital grants are available.

The Investment Tax Credit will decrease the cost of a mill for those farmers who are in a taxable position by offering them savings in the form of income tax.

The budgets in this publication are based on information gathered as of July 1984, in Truro, Nova Scotia. They are meant to provide general guidelines only. The costs can vary from time to time, place to place and even individual to individual (for example, capital cost and annual feed volume). Farmers considering the installation of a feed mill should substitute their own costs where applicable. A worksheet is provided in Appendix III.

APPENDIX I

CALCULATION OF HOME MIXED RATION INGREDIENT COSTS

SYSTEM 1 - GRAIN AND SOYBEAN MEAL PURCHASED IN RAILCAR LOTS

INGREDIENT	COST	16% DAIRY		16% HOG	
		KGS	\$	KGS	\$
Barley	\$170.15/T	600	102.09	810	137.82
Corn	220.95/T	280	61.87	-	-
Soybean Meal	359.60/T	90	32.36	160	57.54
Dicalcium Phosphate	15.10/25 kg	20	12.08	10	6.04
Trace Mineralized Salt	9.75/25 kg	10	3.90	-	-
Salt	9.05/40 kg	-	-	5	1.13
Limestone	3.25/40 kg	-	-	10	0.81
Vitamin Trace Mineral Premix	5.65/5 kg	-	-	5	5.65
TOTALS			\$212.30		\$208.99

APPENDIX I (Cont'd)

SYSTEM 2 - GRAIN AND SOYBEAN MEAL PURCHASED IN TRUCKLOAD LOTS

INGREDIENT	COST	16% DAIRY		16% HOG	
		KGS	\$	KGS	\$
Barley	\$192.70/T	600	115.62	810	156.09
Corn	250.55/T	280	70.15	-	-
Soybean Meal	390.90/T	90	35.15	160	62.54
Dicalcium Phosphate	15.10/25 kg	20	12.08	10	6.04
Trace Mineralized Salt	9.75/25 kg	10	3.90	-	-
Salt	9.05/40 kg	-	-	5	1.13
Limestone	3.25/40 kg	-	-	10	0.81
Vitamin Trace Mineral Premix	5.65/5 kg	-	-	5	5.65
TOTALS			\$236.90		\$232.26

SYSTEM 3 - MOBILE MIX MILL - GRAIN PURCHASED IN TRUCKLOAD LOTS, SUPPLEMENT PURCHASED IN BAGS

INGREDIENT	COST	16% HOG GROWER	
		KGS	\$
Barley	\$192.70/T	815	157.05
40% Hog Supplement	17.30/40 kg	185	80.01
TOTAL			\$237.06

APPENDIX II

TABLE A: APPROXIMATE ANNUAL FEED REQUIREMENTS OF LIVESTOCK
ASSUMING MEDIUM FEED EFFICIENCY

TYPE	KGS
Dairy Cow ^{1/}	1,815
Dairy Heifers ^{2/}	680
Feeder Hog	240
Sow ^{3/}	1,065
Laying Hen	36

1/ There is a tremendous range in dairy cow requirements depending on production as well as feed efficiency.

2/ Yearly average from birth to first calving. Assumed calving age is 27 months.

3/ Two (2) litters per year with three (3) week weaning; 12 pounds per day during nursing and five (5) pounds per day while dry.

TABLE B: ANNUAL FEED REQUIREMENTS ACCORDING TO SIZE OF ENTERPRISE

TYPE	SIZE	TONNES OF FEED
Dairy	30 Cows	54
Without	60 Cows	109
Replacements	100 Cows	181
Dairy	30 Cows	81
With	60 Cows	164
Replacements ^{1/}	100 Cows	242
Hogs	500 Hogs/Year	120
	1,000 Hogs/Year	240
	1,500 Hogs/Year	360
Sows	30 Sows	32
	65 Sows	69
	100 Sows	106
Laying Hens	5,000 Hens	180
	10,000 Hens	360
	15,000 Hens	540

1/ Assumes a ratio of 0.9 replacements per milking female.

APPENDIX III

WORKSHEET FOR ESTIMATING CHANGE IN FEED COSTS

COSTS UNDER PROPOSED SYSTEM:

Annual Capital Investment In:

Equipment \$ _____

Storage Facilities _____

Annual Fixed Costs:

Depreciation: Equipment _____

Buildings _____

Interest on Investment _____

Maintenance _____

Insurance _____

Taxes _____

Annual Operating Costs:

Power & Utilities: _____ tonnes @ _____ _____

Transportation: Actual or _____ Miles @ _____ _____

Repairs: _____ tonnes @ _____ _____

Labor: _____ hours @ _____ _____

Feed Ingredients: _____ tonnes @ _____ _____

_____ tonnes @ _____ _____

_____ tonnes @ _____ _____

_____ tonnes @ _____ _____

_____ tonnes @ _____ _____

(1) Total Annual Costs Under Proposed System _____

(2) Annual Volume of Feed (Tonnes) _____

APPENDIX III(Cont'd)

COSTS UNDER PRESENT SYSTEM:

Annual Cost of Purchased Feed: Total \$ _____

OR

_____ tonnes @ _____

_____ tonnes @ _____

_____ tonnes @ _____

Transportation: Actual or _____ Miles @ _____

Financial Changes

Other

(3) Total Annual Cost Under Present System

(4) Annual Volume of Feed (Tonnes)

(5) Feed Costs per Tonne Under Present System (3 + 4)

(6) Feed Costs per Tonne Under Proposed System (1 + 2)

(7) Net Saving or Added Cost per Tonne Due to Change
